



Cholera rapid response teams activation in Harare, Zimbabwe

SUMMARY

Zimbabwe suffered its largest cholera outbreak in a decade from September 2018. Over 10,000 cases and 60 deaths have been recorded with most cases occurring in the capital city, Harare, which has suffered from chronic underinvestment in its water supply and sewer networks. The initial WASH response was a blanket approach in the epicenter areas. This could not be sustained beyond the start of the rainy season in mid-November when cases of cholera and typhoid usually increase dramatically. With support from UNICEF Headquarters WASH Emergency Response Team, the feasibility and relevance of activating rapid response teams was examined in the context of the Harare outbreak.

Following a rapid assessment of the ongoing response and local capacities, and discussion with specialists of the Centers for Disease Control, UNICEF WASH section took the decision to support Harare City Environmental Health Division to strengthen their ongoing response teams, known as “contact tracing teams”. The proposed support aimed at improving the response strategy in and around the suspected case households to further contribute to cut the transmission of the disease. This “cordon sanitaire” based approach finds its logic in scientific evidences that the risk of transmission within a perimeter of 50 meters is increased by 36 times in the first 3 days compared to households living outside this immediate perimeter¹.

Two weeks after the approval of the support by local authorities, the first joint Harare City-NGO Environmental Health Response teams (rapid response teams) were trained, equipped and active by early November. Such quick process shows that implementing a rapid response mechanism to cholera in an outbreak situation is feasible provided a few pre-conditions. The activation of teams could be further accelerated by having pre-agreement and pre-arrangement modalities in place with local authorities, UNICEF country offices and NGO partners in cholera prone countries. The study concludes that an earlier activation of the teams is likely to have prevented additional cases, especially in areas where cases were clustered.

Introduction

As a response to the cholera outbreak, which began on September 5, 2018, the City of Harare Environmental Health Division deployed its infectious disease control units, through “contact tracing”¹ teams (CTCs), primarily to the most affected suburbs of Glenview and

Budiriro. These teams were composed of Environmental Health Technicians (EHT), who were either staff of the Municipality or seconded as volunteers recently graduated in Environmental Health Science.

¹ Calling those teams “contact tracing” is not adequate considering the nature of their duty which is larger than finding contacts only.

As of October 10, 2018, more than 2,800 cases had been investigated out of a total of 8,669 cases (32%) by these City teams. In addition, more than 10,000 contacts had been screened. They also distributed Aquatabs/Waterguard when available (about 7,800 strips distributed), conducted Free residual chlorine (FRC) testing in stored water, disinfected households with spraying (about 1,320 houses disinfected), and conducted hygiene promotion (more than 10,000 persons reached). These items were only given to the households with cholera cases.

In addition to this work, WASH partners have undertaken massive distributions of water treatment products, soap, buckets, jerrycans, Information, Education & Communication (IEC) materials and hygiene education through door to door campaigns with local volunteers. However, a more targeted response was to be adopted for several reasons: reduction in the daily number of cases and situation in plateau showing a high likelihood of interpersonal transmission, need to prioritize households directly surrounding cases during responses due to higher exposure (through shared latrine or private well, neighbors going in and out of the homes of cases), and the need to optimize available resources as the high risk rainy season approached in mid-November.

Considering the available resources and the willingness of WASH partners, UNICEF proposed to the Environmental Health Division to support the teams to deliver rapid case-area targeted interventions in response to every case in less than 48 hours. It is worth noting while similar rapid response teams have been implemented for long periods of time in larger outbreaks (Haiti, Yemen), the support in Zimbabwe is designed to be for a shorter duration of time (3-6 months) expecting to reach zero case in this timeframe. This required the UNICEF Country Office to initiate this action on an expedited timeline.

Description of the intervention

KEY POINTS

The context of the outbreak, with a reduction in the number of daily cases but still a high transmission of around 100 suspected per week, and several observed favorable conditions were met for UNICEF WASH section to propose this support to the City of Harare (CoH):

1. Funds availability (about 300,000 USD dedicated to this program, funded mainly by ECHO and CERF)
2. Pre-existing local response teams which could be capacitated to strengthen Government response
3. Local authorities' receptiveness and willingness to cooperate
4. NGOs openness to contribute and trust in UNICEF as a partner
5. Number of daily cases prevented the few teams to cover all cases in a timely manner. If the daily incidence had remained high (above 60 cases per day), the number of required teams would have been far higher, considering an average of 4 cases responded per team per day.

Although the transmission in plateau observed since the beginning of October (see Figure 1) was not a pre-condition per se, it suggested that the transmission occurred mostly through person to person contact. This was an additional argument to advocate for rapid response in and around the households with cases, covering both targeted hygiene practices and protection of drinking water against recontamination at home.

Rapid assessment and observation of a favorable context

Following a rapid assessment of local capacities and willingness, conducted by UNICEF, this mechanism was proposed to help the City of Harare to quickly improve the performance indicators of its "contact tracing" teams.

Before the intervention, the infectious disease control unit had 9 teams for contact tracing (including 20 Environmental Health Technician (EHT) volunteers and 10 EHT from the army). EHT volunteers from other Harare districts were also diverted to highly affected suburbs to conduct case investigations and contact tracing of cholera cases.

While this unit has been able to conduct a large number of case investigations and contact tracing, the coverage of cases remains low compared to the number of actual suspected cases and potentially other cases not presenting at CTCs. In addition, the scope of intervention of the contact tracing teams was confined to the case family with no systematic investigation and interventions in the surrounding households.

At the time of the proposal sent by UNICEF to the City of Harare, the following challenges of the contact tracing teams were observed:

1. Low responded cases coverage (about 30%)
2. Cases responded to were done so within several days, sometimes weeks, of delay
3. Case investigation forms were not analyzed
4. Fluctuation of available vehicles for the teams (never more than 5 cars available for 9 teams) which severely hampered the response capacity of the available human resources
5. Irregularity of hygiene supplies availability
6. Large teams that could be split if more vehicles were available
7. Teams only target the households of cases
8. GPS location of cases not plotted
9. Volunteers not receiving any incentive, working 7/7 days, with high risk of fatigue
10. Team leaders lack of mobile phone credit to communicate
11. Missing electronic equipment for data capture: printers, computers, photocopiers, and mapping software

The negotiation

On October 10th, UNICEF and CDC first met with the Environmental Health Manager and the Chief Environmental Health to explain the rationale of the support and its intended content.

Upon the request of the City officers, on October 11th, UNICEF sent a concept note to the City of Harare, detailing the rationale, mostly the challenges faced by the existing teams and the proposed support consisting in reinforcing them, not substituting them. See the [Concept Note](https://tinyurl.com/yaxblc83) (<https://tinyurl.com/yaxblc83>).

One week later, a meeting took place with the Environmental Health Manager, the Chief Environmental Health and two senior Environmental Health Officers. The details of the support and the concept of the case-area targeted interventions were discussed. The City officers emphasized the sustainability issue, arguing they would need to be able to count on having the required equipment, including vehicles, after this intervention to allow their teams to continue by themselves. UNICEF commit to explore long-term solutions during the course of this project.

The UNICEF support was finally clearly defined during this meeting as follows:

12. Identify component NGO partners that have the experience and capacity to support the City on this work
13. Initial stage: renting 8 vehicles to be full time dedicated to response teams, including drivers able to help logistically and to perform household disinfection after short training
14. Providing \$10 daily allowances to EHT volunteers and \$10 weekly phone credit for Team Leaders
15. Providing all supplies required for the response: Aquatabs, soap, IEC materials, HTH, sprayers, PPE, pool testers and reagents
16. Providing 2 data entry clerks based at two of the three CTCs to ensure timely data entry and analysis, equipped with mobile internet keys

Two days later, the Environmental Health Manager approved the proposed support.

Preparatory training

The following week was dedicated to further discussion with City officers and partners to refine the intervention protocol. It was agreed to have a starting date of November 5th with at least two vehicles and then by November 12th to have an additional four vehicles. To prepare this project launching, a preparatory training of half-day at UNICEF was agreed with the City officers.

The training was delivered by UNICEF with support of CDC specialists. 17 persons attended the workshop, 14 EHO and EHT from the City and 3 NGO staff. See [linked training presentation \(https://tinyurl.com/yc43sy98\)](https://tinyurl.com/yc43sy98).

The proposed intervention

In order to quickly improve the response to cases, which involved targeting a systematic response to all suspected cases of cholera within 48 hours, UNICEF proposed the following support through two NGOs partners:

17. In addition to the 5 EHT teams having CoH's vehicles regularly, UNICEF would support 10 teams with vehicles to reach a total of 15 teams; 7 would be based at the Glenview and Budiriro CTCs (supported by Oxfam), 3 would be based at the BRIDH (supported by Goal),
18. UNICEF partners would rent the 10 additional cars, ensuring their daily operation and maintenance, hiring a driver for each of the car, who would be asked to participate in the activities by providing logistical support (transport of kits and preparation, distribution) and potentially support the team for household disinfection,
19. UNICEF partners would do their best to ensure the response teams are supplied (Aquatabs, chlorine solution (HTH) for spraying, bucket/jerrycans, soap, IEC materials, FRC comparators and reagents), would provide incentives to volunteer members of the teams at the locally accepted standard rates, and would provide mobile phone credit for team leaders to a maximum set limit per month,
20. UNICEF would try to provide some electronic equipment to ease the work of the teams and data entry clerks to quickly analyze teams' work

Team tasks

Those combined EHTs-NGO rapid response teams aim at responding to all new suspected cases of cholera by providing a complete package of response within 48 hours, under the leadership and coordination of the Environmental Health Division of the City of Harare. The response is done both at case's

household and surrounding households ("cordon sanitaire") based on the above mentioned scientific evidence. Such a targeted approach remains complementary to wider hygiene promotion campaigns, water protection and treatment, and preventive actions in public places.

Launching the joint teams

Tuesday 6th November, two vehicles hired by GOAL joined the City EHTs teams based at Beatrice Road Infectious Diseases Hospital. Following a briefing to explain the support that UNICEF and GOAL were providing with the two Senior Environmental Health Officers, the EHT members of the teams and the two GOAL drivers, the teams started the first joint response. Vehicles were loaded with the required hygiene and disinfection materials to respond to 4 cases based on the initial assumption that each team can be respond to at least 4 cases per day. Under UNICEF cholera specialist supervision, the first intervention to a suspected cholera patient's home was done with both teams to demonstrate the new approach consisting of undertaking the identified activities to the neighboring households around the patient's home. After that, the teams went to respond to one other case each, one team being accompanied by UNICEF to continue the "training". Teams were accompanied every day for 4 days to ensure the good application of the strategy. On Monday 12th November, four additional vehicles hired by OXFAM joined Glenview and Budiriro CTCs based teams. The induction approach was followed, with all four teams gathered for an initial case response to show the method.

Environmental Health Division supervision

Team composition

1. 1 EH team leader (CoH)
2. 2 EH volunteers (CoH)
3. 1 Drivers/Log/Support (Oxfam, Goal)

Geographical area of intervention:

Teams would be mobile. Being based at the only 3 CTCs of the city, they will have access to

all reported suspected cases in the city and can be deployed in any of the suburbs.

Teams tasks:

Teams respond to at least 80% of all suspect cases within 48 hours, and conduct the following activities:

- Complete case investigation form at CTC and/or household
- Active search of cases at case's house and in the surrounding houses, with immediate referring to CTC
- Hygiene promotion kit use demonstration at case's household and to surrounding households targeting a perimeter of 50 m around the case's house
- Distribution of Aquatabs/Waterguard, soap, buckets, jerrycans, IEC materials
- Houses disinfection targeting toilets (especially if shared toilets), bathroom, house floors, all traces of excreta and vomits, provide recommendation for disinfection of beddings and case's clothes
- Free residual chlorine monitoring at stored household drinking water, tap water most frequented source water near the case's household
- Communicate to Water sampling and chlorination teams (CoH, NGOs) any water points considered at risk in the vicinity of the cases' houses
- Communicate to CoH any sewers burst in the vicinity of the cases' house

Teams were then accompanied in turn every day of the week by the UNICEF specialist. Two additional vehicles start on Monday 26th November to reach a total of 8 teams supported by UNICEF, which is two less than the planned support. Due to the reduction in cases observed (between 15 and 25 cases per day), it was considered that 8 teams with a minimum capacity of 4 cases daily each was enough. In the event of an upsurge of the disease during

the rainy season, existing resources could allow increasing the number of teams.

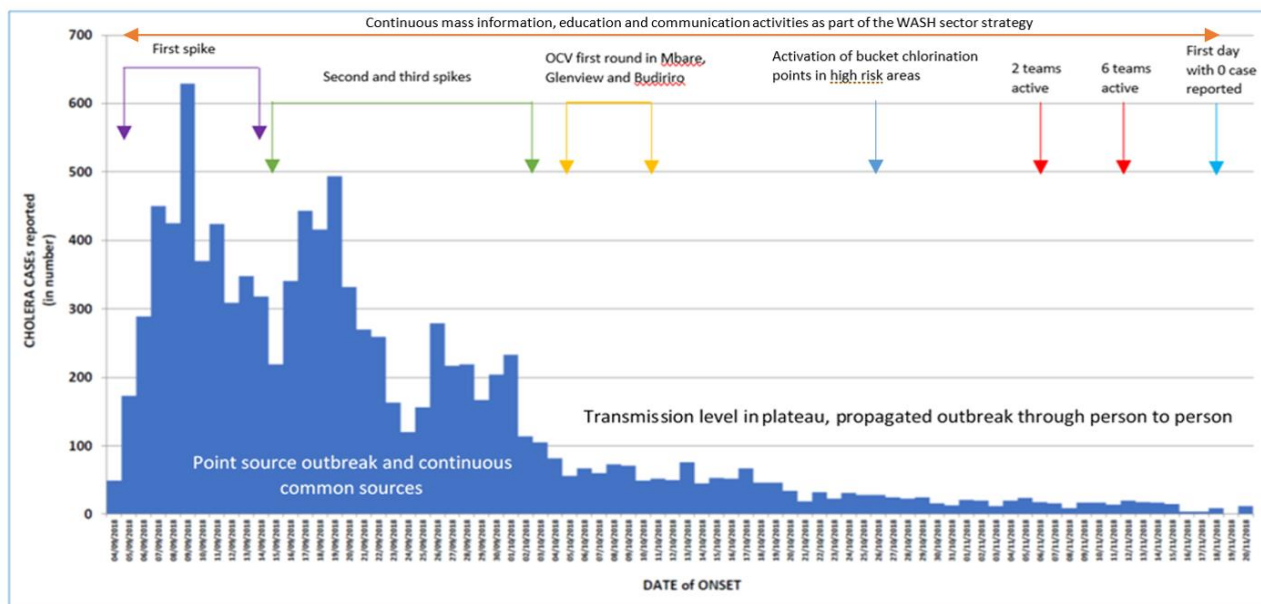
Seventeen days after the go-ahead by local authorities the first teams were active. This was facilitated by the existing partnership with GOAL and the partnership developed with OXFAM. It shows that having pre-existing agreement with local authorities and partners to launch similar system in the event of an outbreak can allow a quick start, probably in less than a week (orange arrow in the graph below showing one the state of the outbreak week after its onset).

When applying this timeframe to the current outbreak epi-curve, it can be seen that if these trained and equipped teams had been activated within first week of the outbreak onset, this could have contributed to limit or avoid the second and third waves (between the two green arrows on Figure 1).

Organization of team work

In order to help the teams better organize their work, two forms were created, the [assignment form](https://tinyurl.com/y7r5e2jn) (<https://tinyurl.com/y7r5e2jn>) and the [supplies sheet](https://tinyurl.com/yd2gm8s8) (<https://tinyurl.com/yd2gm8s8>). In addition to these forms, the EHOs responsible started by themselves to fill a ledger with all new suspected cases. UNICEF recommended to add a column with status of response to ease the follow-up case by case. Later on, it was recommended to provide EHOs responsible with a proper printed registry for this task. While observing the first teams on the ground, UNICEF specialists elaborated a short check-list of key tasks every team is expected to perform while responding to a suspected case. This check-list was progressively improved during the first two weeks and the final version was then distributed at a debriefing meeting with all team leaders, Harare City supervisors and NGOs program managers. The [response protocol/check-list](https://tinyurl.com/yddpu97x) (SOP) (<https://tinyurl.com/yddpu97x>) is available.

Figure 1. Epi curve (as of 23 November 2018) and response timeline



Budiro teams loading car before intervention

To ensure a regular communication between team leaders, a decision was taken to create a

WhatsApp group on which each CTC will communicate to all team leaders every morning the number of cases seen the previous day and during the night. This will allow team leaders to discuss potential needs to support teams based in CTCs receiving more cases than they are able to respond to.

During this first team leaders meeting, it was also agreed to have a short weekly meeting on Friday morning to look at the coverage of cases during the past days with the same idea to ensure teams mobility when cases coverage is below 80% in one given area.

Monitoring and evaluation

The goal of having a good M&E in place is to help improve operations. The use of weekly and monthly monitoring data enables corrective actions or improvement of team performance.

A short list of key performance indicators has been defined to measure team performance on a regular (weekly) basis:

- % of suspected cases responded to within 48 hours
- Average number of households benefiting from each response (to measure the size of the cordon sanitaire)
- Quantities of each distributed item per week (to measure the effectiveness

between the size of the cordon sanitaire and the quantities distributed)

- FRC results from case household stored water and from community water sources

The most important form to be fill out by teams on the ground was the [Household Barrier](#) form (<https://tinyurl.com/yca532rm>) (the chosen translation for the French term "cordon sanitaire"). UNICEF, with support of CDC, provided the form to the teams.

To ensure all data were recorded adequately, UNICEF supported GOAL and OXFAM to hire two data entry clerks based at the CTCs. Once hired, the two clerks received a quick induction training by a CDC specialist.

All forms were entered in KOBO to facilitate the daily data entry and analysis.

A weekly report template was prepared and shared with Harare City for approval – a mirror form exists for typhoid in the expectation that as cholera cases drop the teams can follow-up the presenting typhoid cases in the same manner.

In future, it is expected to have a more qualitative monthly report analyzing both the rapid response data and the investigation forms which the Environmental Health Division has the responsibility to enter into Epi-info.

A Google drive has been created to store all forms and guidance related to teams work with access provided to partners.

Supply requirement

The requirement for supplies is based on

- The hypothesis of a sustained level of transmission of around 30 new suspected cases per day
- A cordon sanitaire of an average size of 15 households around the case's house
- The WASH Emergency Strategic Advocacy Group agreed standard cholera kit containing:
 1. For the case's household: 30 Aquatab tablets (or the equivalent in Waterguard), 1 bar of soap (1 kg), IEC material (4 items), 1 bucket 20 L, 1 jerrycan 20L – depending on their

availability in the current challenging economy where process for basic goods tripled during the cholera outbreak period

2. For the surrounding households: 30 Aquatabs tabs (or the equivalent in Waterguard), 1 bar of soap, IEC material (4 items)
- Residual chlorine comparators and reagents and HTH would also be provided according to needs along with disinfection backpack sprayers to undertake the disinfection.

Variable	Household quantities	Aquatabs	Soap	IEC kits	Bucket	Jerrycan
Number of cases	900	27,000	900	900	900	900
Number of households targeted	13,500	405,000	13,500	13,500	-	-

Initial results

Team satisfaction:

1. Teams confirm that they are able to find new suspected cases in the surrounding families and to refer them to CTCs with this methodology, which improves their active surveillance performance,
2. Volunteers state it is easier for community members to better understand the potential links and risks that surrounding families face, especially when physical separation between houses is porous,
3. Some of the team members take advantage of being better equipped with FRC testing capacity to further investigate surrounding water points and advise communities on risks at sources,
4. Team members say to feel more recognized by the community by having equipment and supplies to deliver in the name of City of Harare
5. The neighbors of the case reached by the teams feel more concerned when targeted hygiene education is done with them rather than with mass education alone;
6. People are very satisfied to understand the risks from cholera and typhoid and how to prevent as outlined in the IEC materials



Neighbors of a case sticking the received posters on the wall and gate of their property.

being distributed, there is a clear request for more information.

GOAL driver performing toilet disinfection at patient's home neighbors house.



7. There is a good understanding and appreciation by the community of the job done by the teams (people advise the RRT which families that the teams should visit because they are in regular contact with the case patient, people indicating other persons in the neighborhood suffering of diarrhea, people requesting toilets to be disinfected, people asking the teams to check their free residual chlorine etc.).

8. Number of cases responded and surrounding families reached: while teams are still improving the process, since November 6th, they have responded to 156 cases and covered 1,603 surrounding households with the standard response package, i.e. an average of about 10 families per case.

9. As indicated in the first complete weekly report below, covering the period 20-25 November, teams have responded to 70% of the notified cases, with 93% of responses done within 48 hours, with an average size of cordon of 13 households, above the average of the first two weeks.

City of Harare Environmental Health Response Teams (EHRTs) - Cholera Weekly Summary						
20-25 November 2018						
Response team indicators	Target	Beatrice Road Infectious Disease Hospital (BRIDH) EHRTs	Glenview Polyclinic EHRTs	Budiriro Polyclinic EHRTs	Total (all EHRTs)	
1	Total number of suspected cholera cases reported to CTC and assigned to EHRTs	---	21	47	16	84
2	Total number of cholera cases responded to by EHRTs	---	18	31	10	59
3	% of suspected cases responded to by EHRTs	80%	86%	66%	63%	70%
4	% of EHRT responses conducted within 48 hours of presentation at CTC	80%	83%	97%	100%	93%
5	Mean number of households visited per case (i.e. "cordon sanitaire")	15 households	11	13	14	13
6	Number of households that received household water treatment products, soap, and IEC materials	---	217	440	174	831
7	Number of households where latrines were sprayed	---	197	53	27	277
Water sources investigated in and around cases' homes						
8	Number of FRC tests taken from stored household water	---	6	27	8	41
9	% of tested case household stored water with FRC \geq 0.5 mg/L	---	17%	4%	25%	10%
10	Number of community drinking water sources investigated during	---	18	31	10	59
11	- Number of Boreholes (handpumps and submersible pumps)	---	4	9	2	15
12	- Number of Municipal Taps	---	6	16	8	30
13	- Number of Water Tanks	---	0	0	0	0
14	- Number of Shallow Wells (protected and unprotected)	---	7	6	0	13
15	- Number of Surface Water	---	1	0	0	1
16	% of community water sources investigated during response	90%	100%	100%	100%	100%
17	Number of Free Residual Chlorine (FRC) tests taken at chlorinated community water sources	---	4	22	3	29
18	% of tested community water sources (tap, borehole with chlorinator) with FRC \geq 0.5 mg/L	---	25%	0%	0%	3%
Start Date of Report (DD/MM/YYYY)		20/11/2018		Below target		
End Date of Report (DD/MM/YYYY)		25/11/2018		Almost at target		
				At or above target		

Quick costs analysis

Quantities of supplies distributed: 24,930 Aquatabs tablets 67mg, 831 bars of soap 1kg, 831 IEC materials kits, 156 buckets 20 L, 156 jerrycans 20 L.

Cost of supplies for one case: average of 4 usd, considering the standard kit for the patient house plus the standard kit for the surrounding households divided by two.

Cost per month for 6 initial teams: 6,000 usd per team, including vehicle hiring (20% of the cost), drivers, EHT allowances, communication costs, data entry clerk salary, program managers salaries.

In theory, with 36,000 usd per month, the 6 teams could respond to 720 suspected and 10,800 surrounding households, benefiting to about 57,600 persons by targeted interventions (using the average of 5 persons per household), i.e. in the areas most at risk during the whole duration of the action. versus non-targeted distributions often through one shot distribution.

Adding the cost of supplies, about 46,000 USD, the total budget for one month considering this number of cases is around 82,000 USD. This gives an average cost per person of 1.4 USD.

The comparison of cost between targeted interventions and blanket distributions done at the onset of the response is unlikely to give coherent results. Indeed, while targeted interventions provide prolonged and regular distribution for a smaller group of people, blanket distributions can be done once for a wider group. At the end of the project however, people reached by targeted intervention can be higher than with blanket depending on the outbreak dynamic. Therefore, the cost could be very similar, but what distinguishes targeted interventions is the fact that people reached live in areas most at risk due to the proximity of cases, which is not the case for blanket response aiming at covering a wider geographical area.

In other contexts, if rapid case-area targeted interventions are initiated at the onset of an outbreak, it could limit the peak and make massive blanket distribution unnecessary. In such a context, one could compare the cost of a theoretical response with blanket distribution

only (repeated or not) and actual targeted interventions.

What is the sustainability of this action?

The first goal of the proposed support was to support the City of Harare to cut the transmission of cholera as soon as possible and to prevent any resurgence during the rainy season.

However, such a mechanism, counting on the dynamism and willingness of local authorities, the support of community health clubs and NGO partners with a long-term presence in Harare, can be a contingency multi-partner mechanism to activate at any given time if the city faces a future cholera outbreak. As a contingency measure, UNICEF could support the establishment of a scaled response plan based on the weekly cholera trend. In addition, such a mechanism can also be utilized to respond to other infectious diseases outbreaks. As a matter of fact, current teams already respond to typhoid cases once all suspected cholera cases have been responded to.

Recommendations

First, immediately ensure the monitoring of cases being responded every day: with the first 6 teams, the assumption is that 24 suspected cases at least can be responded per day, with the current daily incidence, there should not be any backlog. Should this support be repeated in other contexts, the key data to monitor is the response status of every new suspected case, every day. This can be easily done by proposing a [simple adapted line listing](https://tinyurl.com/yap4xpbm) (<https://tinyurl.com/yap4xpbm>), complementing the above-mentioned forms. Note that access to line listing of suspected cases on a daily basis is mandatory for response teams and Health authorities should provide such information as soon as possible.

Second, adapt the response to the context: the initial principle of responding to surrounding

households in a perimeter of at least 50m around the case's house has been modified to prioritize the families living near the case. Indeed, one aspect of most Harare suburbs is that houses are usually shared by several families, sometimes more than 5 in a one single property. Private yards are relatively large (200-300 square meters), with households often communicating between themselves. These multitude of families living in the same yard as the case or nearby are the most at risk considering the density of population in this immediate vicinity. Teams target therefore an average of 15 families (potentially several families per house) around the case. However, they always visit at least the families on each side, in front and behind the case's house,

which are the most likely to have regular contact with the case.



Environmental Health Technicians of Glenview and Budiriro CTCs teams with visible hats and jackets

Third, ensure teams' visibility: one should not neglect the aspect of visibility of the teams. It is of utmost importance for them to be recognized by the population. It allows the visited families to better accept the presence on the teams when seeing that they are officers of the City. It also provides team members with a status in their own community. To this end, UNICEF supplied branded bobs and hats to the members as well as ordering new tee-shirts and raincoats for the upcoming rainy season.

Fourth, start taking GPS location of cases as early as possible: recording the location of each suspected case's house is mandatory for this type of response. However, in a context like Zimbabwe, due to the current economic crisis GPS are hard to find and they are expensive. Alternative solutions must be quickly found because analyzing the distribution of cases on a weekly basis is part of the rapid response activities to understand the local dynamics of the outbreak. In this case, the support of the WHO Information Manager specialist was provided to install an application on each Team Leaders smartphone so that they can easily

have the GPS coordinates of any location and write these down on the provided forms.

Fifth, consider adding chemoprophylaxis to immediate contacts during the response: due to fear of generating anti-drug resistance, antibiotics are done given to close contacts. However, antibiotics can shorten the duration of the infection in both symptomatic and asymptomatic persons, thus reducing the time a person can transmit the disease to others. Delivering antibiotics to close contacts being most at risk is not equivalent to mass chemoprophylaxis. If accompanied by proper anti-drug resistance monitoring, the positive impact on the immediate control of the disease could overcome the risk of negative impact.

Sixth, consider ring vaccination in addition to rapid cordon sanitaire: Few models already demonstrate that ring vaccination completed with rapid WASH intervention around the cases' house, or vice versa, could have a significant impact in controlling an outbreak. Such an intervention would probably be more cost effective than mass vaccination considering the difficulty in reaching an adequate coverage for campaigns done in emergency (particularly in urban contexts). In mass vaccination campaigns the single dose vaccine regimen is common due to shortage of vaccines, there is a risk of generating a susceptible population when the single dose regimen has a lower efficacy and shorter duration than a two dose regimen.

Seventh, consider having pre-arrangements in other cities or provinces, with both local authorities and NGO partners, in the framework of existing contingency agreements. This could enable a joint, coordinated and structured rapid response to outbreak and potentially other types of crisis by having NGOs working in support of authorities, and not instead of them.

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